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First Record of Four Species of Nudibranchia Molluscs from Chromodorididae and Plakobranchidae Families in Syria

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ABSTRACT

Many individuals of alien/lessepsian migrants of nudibranchs molluscs belong to four different species are: *Hypselodoris infucata* (Rüppell & Leuckart, 1830), *Goniobranchus obsoletus* (Rüppell & Leuckart, 1830), *Elysia grandifolia* (Kelaart, 1858), *Elysia ornata* (Swainson, 1840). These species were collected for the first time from the Syrian coast at AL-Rmayleh (Jableh - Latakia) and Tartus between 2019 – 2021

Keywords: Alien Species, First Record, Gastropoda, Nudibranchs, Sea Slugs

1. INTRODUCTION

The numbers of alien species are still increasing in the Syrian marine environment and the whole eastern Mediterranean region as a result of the opening of the Suez Canal, marine aquaculture and shipping through ballast water and fouling (Galil 2009, Zenetos et al., 2012). Most of these species are thermophilic species originating from the Indo-Pacific or Indian Oceans (Galil 2009). Mollusks are ranked first in terms of the number of alien species in Syria (Bitar et al., 2003, Ammar 2004, Ammar 2019), and their number according to (Ammar 2019) has reached 46 species, 57% of total alien species divided into (33 species of Gastropoda, 13.41% of the total and (12 species of Bivalvia, 9.02%) and one species of cephalopods until 2019. And for gastropods, three species of nudibranchs molluscs *Thecacera pennigera* (Montagu, 1813), *Aplysia dactylomela* (Rang, 1828) and *Goniobranchus annulatus* (Eliot, 1904) were recorded in Syria (Ammar 2019). In addition to other species that are still awaiting documentation and are under publication. The characteristics of the Syrian marine environment and the pressures it is exposed to, such as the absence of competitors, the availability of space, the physical and chemical characteristics of the water, and the geomorphological nature of the coast, all of this has allowed the spread of more alien species in it. This article attends to registration of four species of nudibranchs mollusks

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for the first time in the Syrian coast after it had been registered in the Turkish, Lebanese and neighboring countries coasts.

2. MATERIALS AND METHODS

Three Specimens of *Hypselodoris infucata* (Rüppell & Leuckart, 1830), three specimens of *Goniobranchus obsoletus* (Rüppell & Leuckart, 1830) and more than 25 individuals of *Elysia grandifolia* (Kelaart, 1858) and *Elysia ornata* (Swainson, 1840) were collected from a pond in the rocky shore area (1640 m^2) (35°22'42.58"N 35°55'4.68"E) at AL-Rmayleh (Jableh - Latakia) and from Tartus (34°58'06.3"N 35°52'33.1"E) Fig (1) between 2019 – 2021 by free diving at a depths ranging from (1-2) meters. Samples were taken in polyethylene containers and kept in aquarium for a couple of days and photographed in a petri dish. The specimens were classified and described according to (Zenetos et al., 2003, Yonow 2008, Çevik et al., 2016, Kleitou et al., 2019). Nomenclature follows WoRMS Editorial Board (2021) (WoRMS 2021).

Figure 1 Sampling sites at Syrian coast

3. RESULTS AND DISCUSSION

Classifications of the four species:

Kingdom: Animalia; phylum: Mollusca; class: Gastropoda; Subclass: Heterobranchia; Order: Nudibranchia; Family: Chromodorididae; Genus: *Hypselodoris*; species: *Hypselodoris infucata*.

The specimen of *Hypselodoris infucata* (Rüppell & Leuckart, 1830) Fig (2) was about 25 mm long, Back is creamy white and covered with a blue and dark purple to black and yellow patches. Rhinophores are bright orange red and gills are white and bright orange and it's matching all the distinguishing characteristics that says it's clearly differs from all Mediterranean species by the red rhinophores and branchial plume and by its color pattern of yellow and blue spots over a cream or greenish background (Zenetos et al., 2003). And we noticed that they laid eggs in aquarium as it shown in Fig (3). This species was first observed in August, 2020 in Jableh, and observed again twice in October 2021.

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Origin: W Indian Ocean, Red Sea to W Pacific Ocean (Rudman 1984).
Distribution in Mediterranean Sea: Its presence was indicated throughout the eastern Mediterranean Sea (Barash 1977, Özvarol et al., 2010, Crocetta et al., 2013, Crocetta et al., 2017).

Figure 2 *Hypselodoris infucat*a specimens from Syrian coast

Figure 3 *Hypselodoris infucata* eggs

Genus: *Goniobranchus*; species: *Goniobranchus obsoletus*.

The specimens *Goniobranchus annulatus* (Eliot, 1904) Fig (4) was about 20 mm long with white creamy and orange reticulations with a thick purple border, and a thin orange margin. The margins of the mantle are undulated in larger specimens (Yonow 2008, Kleitou et al., 2019). This species was first observed in Jableh in September, 2019, and was observed again in Tartus on June, 2021.

Origin: Endemic to the Red Sea (Yonow 2008).
Distribution in Mediterranean Sea: Cypriote and Turkish part of the Mediterranean Sea (Kleitou et al., 2019, Bariche et al., 2020).

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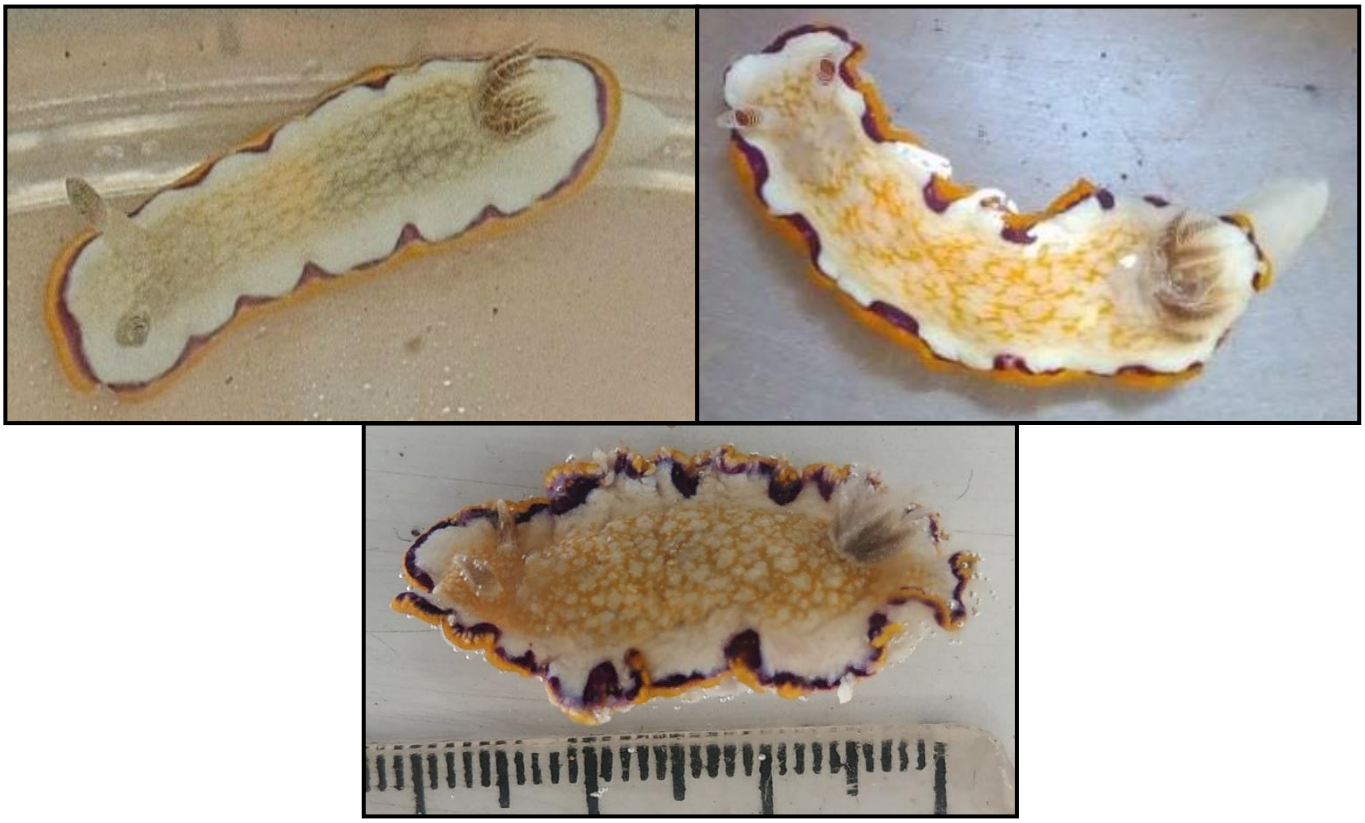

Figure 4 Goniobranchus *obsoletus* specimens from Syrian coast

Family: Plakobranchidae; Genus: *Elysia*; Species: *Elysia grandifolia*.

Elysia grandifolia (Kelaart, 1858) specimens Fig (5) were about 3-5 cm long with dark green to yellowish green body with black spots. The margin has black edge parapodia with an orange margin next to the black. The tips of the tentacles have the same color banding as the body edge (Çevik et al., 2016). This species was first observed in Jableh in September, 2019, and its presence was permanent during the summer of 2020 and 2021, and was recorded in Tartus in September, 2020.

Origin: Indian Ocean (Kumar et al., 2011).
Distribution in Mediterranean Sea: along the Eastern Mediterranean shores (Çevik et al., 2016).

Figure 5 *Elysia grandifolia* (Kelaart, 1858) from Syrian coast

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Family: Plakobranchidae; Genus: *Elysia*; Species: *Elysia ornata*.

Elysia ornata (Swainson, 1840) specimens Fig (6) have the same characteristics as *E. grandifolia* except of the presence of a white line separates the black and orange margins in *E. ornata* (Jensen 1992) Fig (7). This species was only observed in Jableh in September, 2019.

Both of *E. grandifolia* and *E. ornata* were found feeding on *caulerpa taxifolia* algae and we noticed that they laid eggs in aquarium as it shown in Fig (8).

Origin: Circum-tropical: Caribbean and Indo-West Pacific (Jensen 1992).
Distribution in Mediterranean Sea: along the Eastern Mediterranean shores (Çevik et al., 2016).

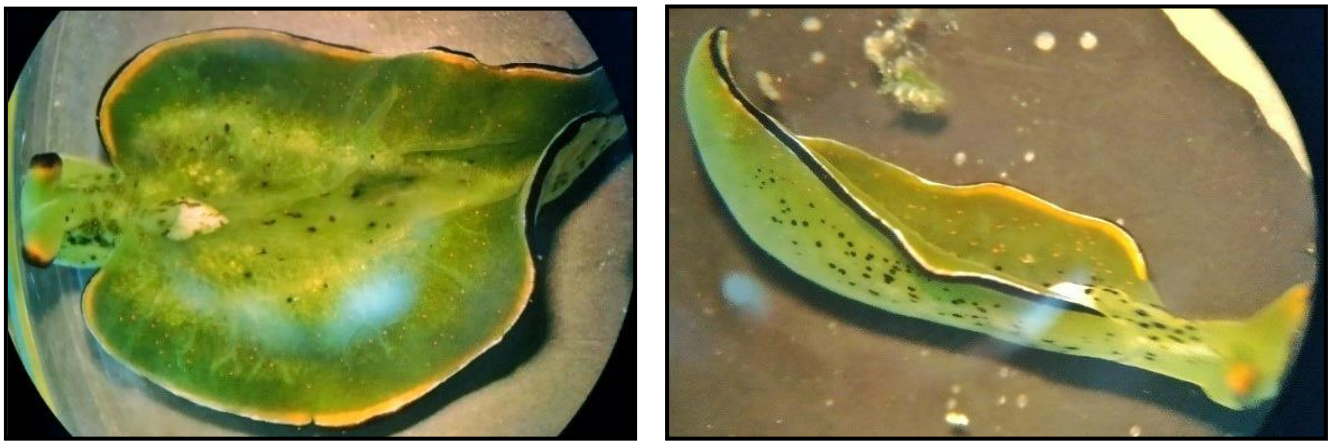
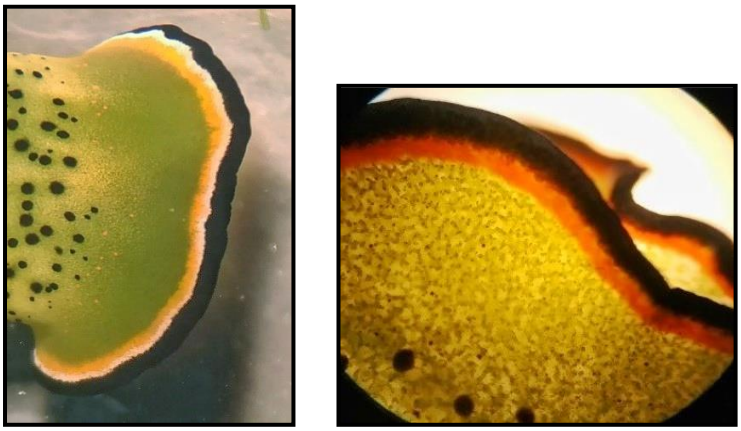


Figure 6 *Elysia ornata* (Swainson, 1840) from Syrian coast



A B

Figure 7 shows the presence of the white line in *E. ornata* (A) and its absence in *E. grandifolia* (B) (Jensen 1992).

Figure 8 shows *E. grandifolia* and/or *E. ornata* eggs

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It is certain that these species of mollusks had arrived via the Red Sea by the Lessepsian migration and that they succeeded in spreading throughout the eastern Mediterranean, even in not large numbers, as is the case of the two species *H. infucat*a and *G. obsoletus*, While the two species *E. grandifolia* and *E. ornata* dominate in large numbers on the rocky substrates of the study sites. The presence of this species in two areas of the Syrian coast indicates the success of this species in stability and settlement.

4. CONCLUSION

These species constitute a new and important addition to the list of alien species in Syria. Since their presence has been recorded in neighboring countries, this means that more research or more efforts will allow to fill the knowledge gaps related to the spread and distribution of alien species in the eastern Mediterranean.

Ethical approval: The ethical guidelines are followed in the study for the collection of Specimens approved by Latakia aquarium.

Funding: This study has not received any external funding.

Conflicts of interests: The authors declare that there are no conflicts of interests.

Data and materials availability: All data associated with this study are present in the paper.

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